



Build With Propane Guide: Commercial Edition

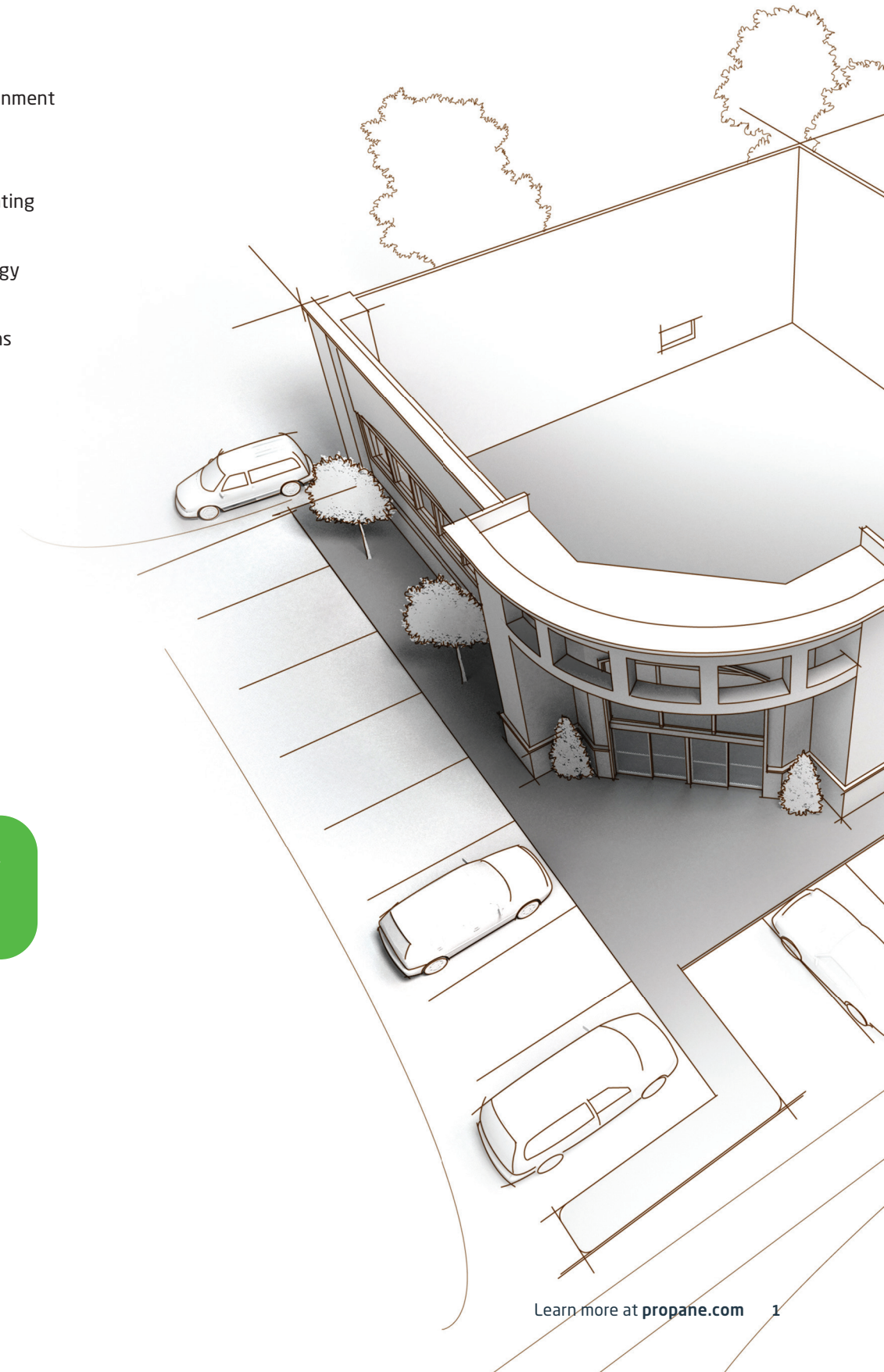
YOUR HANDBOOK
FOR PROPANE SYSTEMS,
NEW TECHNOLOGY,
AND PRODUCTS



Table of Contents

- 02 Introduction to Propane
- 04 Propane Storage Systems
- 06 Green Building and the Environment
- 09 Attributes of Propane
- 10 Propane for Architects
- 12 Space Heating and Water Heating
- 16 Power Generation
- 19 Propane and Renewable Energy
- 20 Outdoor Living
- 21 Propane in Building Operations
- 22 Restaurants and Retail
- 24 Propane in Schools
- 26 Propane in Hospitality
- 28 Propane in Warehouses
- 30 Propane on the Jobsite
- 32 Propane Autogas

If you're new to propane,
consider this guide a
warm introduction.



Performance Delivered

No matter what role you have in the commercial construction process, you share a set of common goals for your building: top-notch performance and efficient, low-cost operation. That means you need a clean, flexible, and reliable energy choice that will help you meet those goals.

If you're new to propane, consider this guide a warm introduction. You'll learn about the basic properties and attributes of propane, how it's delivered and used in commercial construction projects, and the typical applications that are fueled by propane. If you're already building with propane, this guide will help you learn more about propane's versatility in commercial construction. You'll discover innovative technologies and energy and environmental advantages that will help you construct a building that meets even the highest performance goals.

Over the last several years, the Propane Education & Research Council (PERC) has invested millions of dollars in research, videos, training courses, and guides such as this that focus on propane applications, including new technologies, installation, maintenance, servicing, and safety. We've found that propane is versatile enough to fuel projects ranging from a remote park cabin to a sprawling luxury resort. With the information in this guide, you'll have the awareness and resources you need to incorporate clean, efficient propane into your projects.

PROPANE IS VERSATILE

It can fuel projects ranging from a remote park cabin to a sprawling luxury resort.

Today's Propane

AMERICAN ENERGY

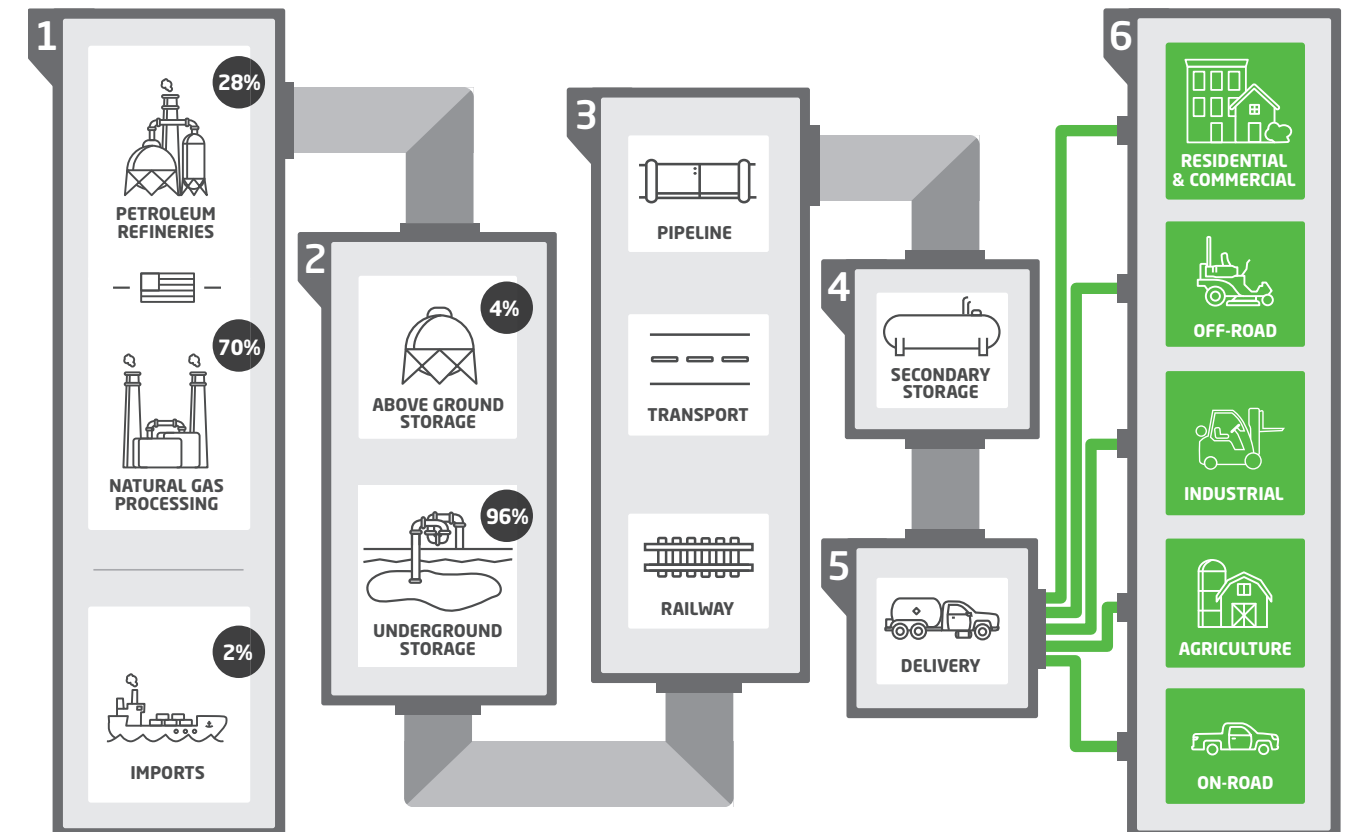
Propane is a nontoxic gas produced from natural gas processing and crude oil refining. Propane is made here in America. In fact, the United States is a net exporter of propane, which means we make more than enough to meet demand. In the wake of the shale revolution, domestic propane supply has greatly increased.

Propane can strengthen America's energy security while powering our vehicles, forklifts, and commercial mowers; heating our homes and commercial spaces; and fueling American farming and manufacturing.

CONSTRUCTION-FRIENDLY

In commercial construction, propane is used much like natural gas. It provides fuel for energy-efficient gas space heating, water heating, cooking, fireplaces, and clothes drying, though it can also fuel a variety of other building needs. The primary difference is that propane is stored on site in tanks that are regularly filled by bobtail truck or highway transport vehicle. Propane brings all of the advantages of gas to buildings at a cost that's competitive with other energy sources.

Propane is versatile, and it's easy to incorporate in a construction project. With propane, you're not at the mercy of a public utility. And with the option of aboveground or underground storage tanks, propane professionals can install and connect building systems and other applications on your schedule. Propane also provides jobsite flexibility by providing gas energy for portable generators and temporary construction heaters.



Propane Systems

Propane is quickly expanding into commercial construction markets through innovations in commercial tank manufacturing and commercial distribution networks. Propane can now be used for any gas commercial building application that does not have easy access to natural gas, including new construction, interior construction for new tenants, major renovations, and building efficiency upgrades.

There are three components to a commercial building's propane infrastructure: storage (tank), distribution system (piping network), and optional components.

STORAGE (TANK)

Propane tanks can provide on-site propane storage for commercial building projects of any size, from the smallest commercial building to a sprawling resort or retail complex. Sizes range from 125-gallon tanks for spot energy needs to 120,000-gallon storage tanks. One tank can be sized to serve all of a building's gas energy needs based on its total maximum load, measured in British thermal units (Btu), or multiple smaller tanks can be manifolded together.

Propane storage can be underground or aboveground. Tanks can be placed at multiple sites throughout a project, or one central tank can be used with gas piping running throughout the complex of commercial buildings.

Placement of the propane storage is easily addressed, even in complicated efficiency upgrade scenarios. Your propane supplier will work with you and your client to determine the proper size and number of tanks to meet the building's propane needs and site plan. Tanks can be fenced, buried, or landscaped to enhance security, safety, and aesthetics.

DISTRIBUTION SYSTEM (PIPING NETWORK)

Propane distribution systems are designed to be similar to natural gas systems. Underground gas mains deliver the propane to individual service points on buildings. Outside gas piping is buried according to locally applied codes and standards.

National Fire Protection Association (NFPA) standards govern the use of propane and gas in buildings. NFPA 58 (Standard for the Storage and Handling of Liquefied Petroleum Gases) is the main resource for tank and underground gas line installation, and NFPA 54 (National Fuel Gas Code) governs inside gas piping installation. Visit nfpa.org for more information.

COMMUNITY PROPANE SYSTEMS

For mixed-use developments or large commercial projects with many individual fuel users, such as a resort or mall, a community propane system may be the best option.

Community propane systems are centralized gas systems that provide a scalable and flexible energy solution. The systems distribute propane gas through a network of underground pipes that connect to homes or buildings with individual gas meters. This makes them virtually identical to natural gas systems, but with the advantage of being available almost anywhere in the United States.

In addition to homes and businesses, community systems can also power other amenities such as standby generators, pools, clubhouses, and gas lamps. Providing gas energy in large developments is much easier with this type of versatility.

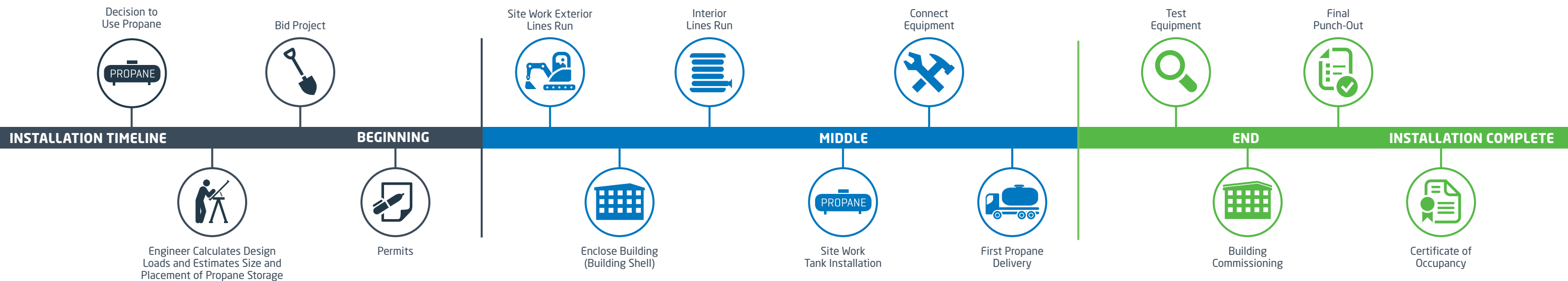
A propane provider will work with you to design and install the central tank (or tanks) and piping system. These professionals know the federal and state regulations you must meet to ensure your community system is up to code. They will typically monitor and refuel the central tank, as well as perform ongoing maintenance of the system. For construction pros, homeowners, and tenants, maintaining a community propane system is hands-off and worry-free.

OPTIONAL COMPONENTS: REMOTE TANK MONITORING

Propane tanks for commercial use are typically remotely monitored by your propane supplier to ensure that the propane supply is reliable and uninterrupted. These smart monitoring devices allow propane companies to track their customers' propane levels and average usage so they can schedule propane deliveries when needed. Some of today's advanced monitoring systems also integrate with building management systems and allow owners or facility managers to also track their propane usage.

OPTIONAL COMPONENTS: METERED SERVICE

Propane metering is a hassle-free way of providing sub-metered propane service to retail tenants, even if they draw from the same propane storage. Just as with electric or natural gas service, your propane company can install individual unit meters so tenants can be billed for the propane they use each month. With meters, you won't have to devise a way to divvy up the costs of unequal use among the tenants, or simply attempt to recoup the cost with higher rent. Meters provide an accepted way to bill the exact cost of propane to the individual tenants who use it.



Propane and Green Building

Commercial construction projects, interior work for tenants, renovations, and efficiency upgrades are often measured in their environmental effectiveness by standards such as Leadership in Energy & Environmental Design (LEED), ANSI/ASHRAE/IES Standard 90.1, and the International Green Construction Code (IgCC). Propane can go a long way toward helping a project meet these green building standards. For example, in LEED v4, commercial building projects may be eligible for up to 28 points – mostly related to the Energy and Atmosphere provisions. The IgCC has a similar approach to voluntary green rating systems, but it makes many of the voluntary points in other rating systems mandatory in order to comply with the code. Here are some ways propane can help builders earn points toward LEED certification in these and other categories:

EFFICIENT HEATING

Energy and utility savings derived from propane-fueled furnaces, boilers, and water-heating systems can help designers and engineers exceed standard-efficiency systems.

TEMPORARY HEAT

Portable propane-fueled construction heaters can help meet LEED requirements for clean indoor air quality during the construction and pre-occupancy phases of building.

METERS

Developers can earn one point toward LEED certification for installing propane meters for individual tenants or the whole building.

PROPANE AUTOGAS

A LEED credit is available for buildings that install alternative-fuel refueling stations or provide low-emitting and fuel-efficient vehicles, maintenance vehicles, or buses, such as those fueled by propane autogas.

MOWERS

The use of propane-fueled mowers can help earn a LEED point by achieving emissions reduction requirements from site management equipment.



Propane increases energy independence and reliability.

Propane And The Environment

LOWERING EMISSIONS

In an effort to combat the challenge of global warming, architects and building owners are increasingly focused on reducing the carbon footprint of their buildings. Propane's low-carbon output is consistent with many of the design approaches the industry is taking to reduce greenhouse gas emissions.

On the continuum of energy choices, from clean to dirty, propane is closer to renewables than it is to coal, oil, and wood. Propane produces 43 percent fewer greenhouse gas emissions (GHG) than using an equivalent amount of electricity generated from the U.S. grid. That's because propane is used as a primary source of energy on site, whereas a significant portion of U.S. grid power comes from power plants fueled by high-emission coal, and power plants are, at best, about 40-50 percent efficient.

Propane-fueled technologies also produce fewer nitrogen oxide (NOx) and sulfur oxide (SOx) emissions than technologies fueled by electricity, gasoline, and diesel. Because NOx and SOx contribute to acid rain formation and cause respiratory ailments, manufacturers must comply with laws that set limits for these emissions.

SUPPORTING RENEWABLE ENERGY

Propane can supplement renewable energy systems, due to its low emissions and ease of on-site storage. For example, a propane generator can provide auxiliary power to supplement a solar photovoltaic panel system or wind turbine when the sun doesn't shine or the wind is still. Propane boilers or furnaces can also serve as auxiliary heating sources for systems fueled by biomass, solar thermal, or electricity from renewable sources. Having propane as a backup source often allows designers to downsize the renewable installation, reducing upfront costs and making the transition to renewable energy more affordable.

RENEWABLE PROPANE

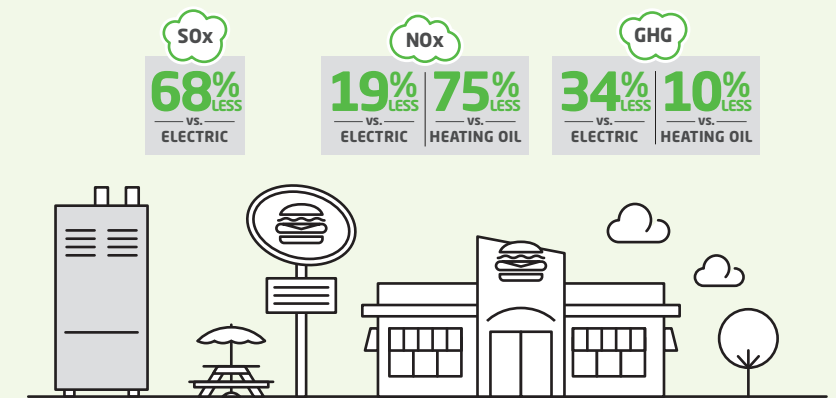
The propane industry is decarbonizing as well. Renewable propane is produced by converting plant and vegetable oils, waste greases, and animal fat into fuel. It delivers a high energy conversion so Btus aren't wasted and is price competitive. It can be used in the same applications as traditional propane.

Renewable propane has a low carbon intensity – it can be as low as 19, whereas conventional propane has a carbon intensity of 77. Agricultural byproducts such as biomass could be used to produce renewable propane at larger scale in the future.

SPACE-HEATING EMISSIONS ADVANTAGE

Propane furnaces produce fewer greenhouse gas and pollutant emissions than electric or heating oil in buildings such as restaurants.¹

1. GHG and Criteria Pollutant Emissions Analysis. Gas Technology Institute for PERC, 2017.



A propane generator can provide auxiliary power to supplement a solar photovoltaic panel system when the sun doesn't shine.



Learn more at propane.com

Propane and Resilience

KEEPING BUSINESSES RUNNING

In areas where natural disasters have occurred, architects and building owners have discovered the value of designing and operating more durable commercial properties. From a business perspective, this makes sense: A business can't afford to lose valuable equipment, inventory, or infrastructure.

Yet resilient building is about more than "sturdiness." Resilience is the ability to function after or during an ongoing natural disaster or accidental power outage. Propane is locally stored and readily available in the event of a catastrophic failure of the grid. A propane standby generator can save a business thousands of dollars by keeping the doors open and the lights on.

A reliable propane standby generator is a key part of resilient design, allowing a business to:

- Resist hazards brought on by major disasters.
- Keep employees engaged and productive during what would otherwise be downtime.
- Continue providing necessary services and products to its customers.
- Reduce the magnitude or duration of a disruptive event.

PROPANE'S ROLE IN EMERGENCY SCENARIOS

Although propane is perhaps best-known for protecting homes, hospitals, and critical infrastructure with standby generators, propane companies are well-equipped to quickly respond to other emergency energy needs. Propane companies frequently work with FEMA or other government contractors to provide heat for temporary structures, fuel for mobile kitchens, and hot water for mobile showers and laundry facilities, for example. During 2020's COVID-19 pandemic, propane provided critical energy for temporary overflow hospitals and testing sites.

The response during these emergencies is likely to involve federal, state, or local governments; equipment vendor and rental facilities; disaster recovery and mitigation contractors; and insurance companies. Partnering with these responders, propane companies can consult on tank sizing options, safe placement, and permitting, and they can supply and install the equipment needed to connect the propane fuel source to heaters or other propane-powered equipment.



Propane is locally stored and readily available.

Propane Fundamentals

Pros will find that the fundamental characteristics of propane are consistent not only with their environmental and resilience objectives, but also with project goals regarding performance, safety, and occupant comfort. Here's what building professionals and their clients should know about propane.

IT'S CLEAN ENERGY

Propane can reduce greenhouse gas emissions by as much as 40 percent compared with electricity in applications such as water heating, because much of the nation's electric power is generated by coal- and oil-fired power plants. Propane has similar advantages over heating oil. For example, recently a Maine YMCA switched from heating oil to propane for its space and water heating, resulting in a CO₂ emissions reduction of 183,000 pounds per year – the equivalent of taking 17 cars off the road every year.¹ By using propane and related applications, construction pros can earn points under green building programs, such as the LEED Rating System.

IT REDUCES ENERGY COSTS

Many propane systems and appliances are more efficient than their electric counterparts. For instance, more than 100 commercial tankless water heater models with a thermal efficiency of 94 percent or higher are listed in the Air-Conditioning, Heating, and Refrigeration Institute's Directory of Certified Product Performance. The highest-rated models are rated at 98 percent thermal efficiency.

IT'S VERSATILE

Propane allows you to construct your buildings with first-rate amenities regardless of where they are located. Propane can fuel a building's vital systems, including power generation, space heating, and water heating, even if the building is located off the grid, without access to off-site energy sources such as electricity or natural gas.

IT PROTECTS YOUR POWER SUPPLY

Standby generators fueled by propane enable a business to stay open during severe storms that bring widespread power outages. With propane available, on-site generators maintain lighting, refrigeration, heating, and air conditioning, while propane-fueled appliances such as water heaters can continue to operate without interruption.

IT PROVIDES MAXIMUM COMFORT

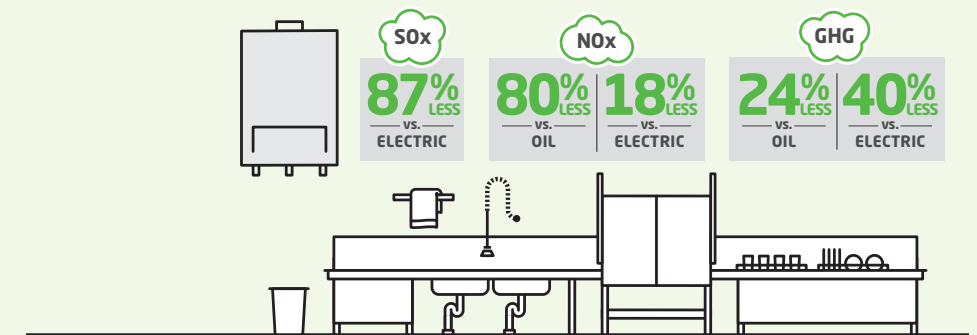
With options such as energy-efficient propane furnaces, which heat air to a much warmer temperature than electric heat pumps, and propane fireplaces, hearths, and outdoor heaters, which keep guest areas and outdoor patios inviting and toasty, propane amenities and heating systems turn buildings into comforting and appealing destinations.

IT'S DESIGNED FOR SAFETY

Typically used in gas form, propane is stored and transported as a liquid under pressure. Propane is nontoxic and odorless, so processors add a chemical odorant (ethyl mercaptan) to help users detect leaks by way of an easy-to-identify rotten-egg smell. The propane industry's voluntary Certified Employee Training Program (CETP) helps ensure that propane installation and service personnel are well qualified to handle even the most challenging tasks. In addition, propane is a well-regulated industry that follows the codes and standards set by the NFPA, the Department of Transportation, the Department of Energy, and various state and local regulatory bodies. For more information, go to [Propane.com/Safety](https://www.propane.com/safety).

TANKLESS WATER HEATING

Tankless water heaters produce fewer greenhouse gas and pollutant emissions than electric or heating oil in buildings such as restaurants.²



1. Newport Partners LLC. Maine YMCA Saves Time and Money with Propane-Fueled Space and Water Heating System. Case Study. Washington, D.C.: Propane Education & Research Council, 2013.

2. GHG and Criteria Pollutant Emissions Analysis. Gas Technology Institute for PERC, 2017.

Architects & Engineers

If you're an architect or engineer, your clients are demanding informed recommendations on building and energy systems that maximize the value of their projects. You need to know about the latest technologies for energy-efficient space heating and water heating, amenities like gas cooking and outdoor living, and energy systems that are dependable and safe.

Engineers must help the construction team understand the financial and practical implications of any energy decision. Specifying propane offers an option that manages a building's energy costs while delivering performance and comfort amenities in a variety of building types.



Maximize the value of your projects.

BUILDING DESIGN

Here are the commercial propane applications that can help you achieve your design vision while maintaining affordable energy and construction costs.



FURNACES

Commercial gas furnaces are self-contained units that supply heated air to condition a wide variety of spaces. And with heated air leaving a propane furnace at a significantly warmer temperature than some electric options, spaces are heated steadily and with reliable comfort.



CLOTHES DRYING

Commercial propane clothes dryers provide laundry functions for numerous building types, with a range of capacities to meet specific needs. Propane dryers outperform electric units by providing faster drying times, which supports increased throughput.



BOILERS

Propane boilers offer value to commercial buildings by serving both space-heating and hot-water applications with high efficiency levels, reliable systems, and versatile designs. Propane boilers can also provide high volumes of hot water for domestic consumption as well as related applications like laundry, often with the same boiler that provides space heating.



FIREPLACES

Propane fireplaces and fire pits add warmth and ambience to guestrooms and welcome areas and can provide comfy, efficient heating. Commercial fire features offer bold flames and contemporary styling.



TANKLESS WATER HEATERS

Propane tankless water heaters offer an innovative, high-performance water-heating solution for commercial applications. Tankless water heaters are compact, energy efficient (up to 98 percent), and deliver endless, on-demand hot water. And with a life cycle as long as 20 years, they provide a strong lifetime value for commercial applications.



GENERATORS

Propane-powered standby generators offer clear advantages over diesel regarding fuel storage, fuel maintenance, and reliability.



STORAGE TANK WATER HEATERS

Propane storage tank water heaters offer superior hot water delivery, reduced energy costs, and faster recovery rates compared with standard electric storage tank units. Featuring storage tank capacities of 100 gallons or more and the ability to heat water up to 180 degrees Fahrenheit, commercial storage tank water heaters are a more robust version of common residential units.



COMBINED HEAT AND POWER

Combined heat and power (CHP) units also produce electricity for a building, but they capture the propane engine's waste heat to create hot water, reducing a building's energy costs.



OUTDOOR LIVING

With an array of options, propane outdoor amenities can distinguish a business by creating unique and inviting environments. Outdoor applications include kitchens and grills for cooking, fireplaces and fire pits for both heat and aesthetics, patio heaters that provide portable space heating, decorative flame lighting for impressive ambience, and pool and spa heaters for year-round outdoor entertainment.



COOKING

Propane cooking equipment delivers professional-grade performance while decreasing fuel consumption and providing convenience and functionality in any commercial kitchen. Propane kitchen products feature greater temperature control, instant-on burners, greater capacity levels, even heat distribution, and design flexibility.

Space Heating

SPACE HEATING WITH FURNACES

Propane furnaces offer great flexibility in both the type and capacity of the equipment, which makes them a good fit for many different commercial buildings. With zoned heating capabilities, capacities from 44,000 to more than 1 million Btus/h, and efficiency levels of 80-98.5 percent, these furnaces can meet very specific commercial demands.

A critical feature of propane furnaces is their ability to condition different zones of a building. This allows the use of multiple, smaller furnaces (often packaged as Roof Top Units or RTUs) to meet the heating needs of just one part of a building. Zoning offers improved efficiency and temperature control in the space, as well as modularity that can simplify installation and maintenance.

SPACE HEATING WITH BOILERS

Commercial propane boilers are used to generate hot water or steam for various building applications. They can be categorized as either condensing or non-condensing types, with condensing units having higher efficiency ratings. In space-heating applications, these boilers can work in conjunction with a number of heating delivery systems.

The ability to supply domestic hot water in addition to space heating makes propane boilers ideal candidates for commercial installations.

HEATING OIL CONVERSION

While many buildings in the Northeast use legacy heating-oil systems, heating oil has consistently lost market share at a rate of about 2 percent per year as propane, natural gas, and electricity have increased in popularity. There are several reasons for this shift:



EFFICIENCY

Heating equipment fueled by propane or natural gas is available at higher efficiency ratings than what's commonly available for oil systems.



ENVIRONMENTAL ISSUES

Several states in the Northeast are phasing in low-sulfur heating-oil regulations.



STORAGE

Heating-oil systems come with an oil tank storage system, which can be smelly, dirty, and expensive and time-consuming to maintain. Propane tanks, on the other hand, can be safely installed underground and are periodically inspected for safe operation by a propane retailer.

When it comes time to upgrade or replace heating-oil equipment, converting to propane can eliminate costly heating-oil repairs, and reduce maintenance costs, efficiency losses, carbon emissions, and environmental risks.

Water Heating

STORAGE TANK WATER HEATING

Versatile, proven, efficient, and dependable, high-volume commercial propane water heaters have high output capacities well suited for the high-demand applications often found in restaurants, hospitality, and health care. Tank-type water heaters maintain hot-water temperatures, depending on the need of the commercial business, typically at 110-180 degrees Fahrenheit.

New propane storage tank water heaters have efficiency features such as added insulation to reduce heat loss from the stored water and electronic ignition to eliminate the fuel consumption of a standing pilot light. Newer units also have increased burner surface area to optimize heat transfer and overall efficiency.

ENERGY COST RESULTS FOR PROPANE AND ELECTRIC STORAGE TANK WATER HEATERS

INPUTS	PROPANE STORAGE	ELECTRIC STORAGE
Energy Factor	0.67	0.95
Unit of Measure	1,140 gallons	21,564 kWh
Annual Energy Cost	\$2,284	\$3,235
Lifetime Energy Cost	\$23,685	\$31,412
Life Expectance (years)	13	13
Assumed Daily Water Consumption (gal)	300	300

Notes:

- Assumed rates \$0.15 kW for electric and \$2.00 per gallon for propane.
- Commercial property owners should also consider the electric demand charge (\$/kW) in estimating their unit costs. Heavy electric demand at any given time, as would be the case with electric water heaters, will increase demand charges.
- Calculator site: <http://www.energy.gov/eere/femp/energy-cost-calculator-electric-and-gas-water-heaters-0>.

TANKLESS WATER HEATING

Tankless water-heating systems can offer commercial buildings big improvements in terms of performance, energy use, and energy costs. In fact, Energy Star-rated tankless water heaters have the potential to use 25 percent less energy than a conventional commercial water heater.

Instead of storing water, propane tankless systems use a heat exchanger to heat water just as it's needed in a building. For example, when a guest turns on a shower in a hotel, a propane or natural gas burner in the tankless unit quickly heats up the heat exchanger. In very high-efficiency models, incoming cold water is preheated from the combustion exhaust. Then the water continues to be heated as it passes through the unit's heat exchanger and exits from the tankless unit at the hot-water outlet pipe, where it then flows to the shower to meet the hot-water demand.

One of the most important benefits of using tankless technology in commercial buildings is this technology's flexibility to meet a wide range of load types. Many commercial tankless systems are modular, so individual tankless units can be combined to create a larger system, offering a wide range of capacity and hot-water output.



Tankless Water-Heating Innovations

TANKLESS WATER HEATER ARRAYS

Linking a system of multiple tankless water heaters together used to be a time-consuming process for contractors. But in recent years, manufacturers have simplified the process with tankless water heater arrays or racks: free-standing or wall-mounted multi-unit systems shipped to projects fully assembled, including gas and water manifolds. They are also available with common venting systems, which further speeds installation by allowing the entire rack to use the same exhaust and intake venting.

In many commercial tankless systems, the capacity of an individual tankless unit is roughly 199,000 Btus. By combining these units in larger configurations, tankless arrays can provide hot-water output rates of several hundred gallons per minute.

COMMERCIAL HYBRID WATER HEATERS

Commercial hybrid water-heating systems such as Rinnai's Demand Duo combine the on-demand, continuous hot-water supply of a tankless water heater with a hot-water storage tank. Although tankless water heaters have made inroads in the commercial market in recent years, storage tank water heaters remain the predominant technology. Hybrid systems combine the best of both worlds – installing just like a storage tank for easy replacement of old units but performing like a tankless water heater with a continuous flow of hot water.

AI, SMART CONTROLS, AND LARGER CAPACITIES

Computerized controls allow even large tankless water heater arrays to precisely track the water-heating load of a building and activate individual units accordingly. Those controls are what make it possible for the tankless system to ramp up to meet a building's peak load and then ramp back down so just a single unit is active.

Today, commercial tankless water heaters have joined other building technologies in offering wireless connectivity and remote monitoring and controls. Many units offer smartphone or app-based connectivity to provide facility managers or contractors with mobile access to their units.

Tankless water heaters are even utilizing artificial intelligence. Water heater manufacturer Intellihot Green Technologies touts AI built into its units that analyzes a building's hot-water usage patterns, identifying and predicting the timing of peak loads so that the units can fire up and activate a building's recirculation system in preparation for the higher hot-water demand.



Tankless arrays can provide outputs of several hundred gallons per minute.

Flexibility For Any Project

Here are a few examples of how propane tankless water heaters can solve your water-heating challenges.



Modest demand

SMALL RESTAURANT

Primary Concerns	Space savings, performance
Hot-water needs	Sinks, dishwashers, cooking, bathrooms
Challenges	Meeting high supply temperatures required by code with tight space constraints
Solution	1 high-efficiency tankless water heater
Result	A 96 percent efficient unit provides 140-degree water for dishwashing and cooking with no drop-off in capacity, and it can be installed outside or tucked away with a wall mount



Medium demand

COLLEGE RESIDENCE HALL

Primary Concerns	Efficiency, performance
Hot-water needs	Shower and bath facilities for 120 residents
Challenges	Efficiently meeting high peak demand alongside extended partial-load periods
Solution	3 high-capacity tankless water heaters
Result	With a total capacity of 750,000 Btus, this array can easily modulate to meet high-demand periods without the standby losses of storage tank water heaters



High demand

MID-SIZE HOTEL

Primary Concerns	Efficiency, space savings
Hot-water needs	130 guest rooms, restaurant, laundry
Challenges	Efficiently meeting high peak demand with tight space constraints
Solution	17 tankless water heaters in 3 arrays
Result	By combining wall-hung tankless units into arrays with common vents, the system can fit into a tight mechanical space while ensuring an efficient water supply that meets peak demand



Very high demand

VACATION RESORT

Primary Concerns	Performance, reliability
Hot-water needs	700 guest rooms, 3 restaurants, large laundry facility
Challenges	Meeting high peak demand so guests don't experience cold showers
Solution	175 tankless water heaters
Result	Rather than the expense of heating enormous hot-water storage tanks, a large resort can efficiently meet demand when needed and have peace of mind knowing guests are happy

Generators

For a business, a power outage isn't merely an inconvenience. It can be a catastrophe, with late shipments, massive loss of inventory, or a reputation on the line. A propane standby generator that can keep a building functioning during a power interruption can help you provide clients with resilience, security, and peace of mind.

By initiating the resilient building conversation with your commercial customers, and stressing the importance of a propane standby generator as part of their plans, you can:

- Set yourself apart from competitors who aren't resilient designers or builders.
- Increase the perception of quality and value of your commercial building projects.
- Proactively meet customer's needs with a solution that meets emissions, reliability, and performance goals.

PROPANE GENERATORS

A propane standby generator offers quiet power, efficiency, safety, and low greenhouse gas emissions. Here are some attributes of propane generators to consider:

- Permanently installed and supplied by an above- or belowground tank, it starts automatically, usually less than 10 seconds after a main-power interruption.
- Propane doesn't degrade over time, unlike diesel or gasoline, making it an effective standby power fuel.
- Many generators produce as little as 63 decibels of noise: less than a household vacuum cleaner.
- Available in a variety of capacities, they can power everything from small businesses to hospitals, manufacturing facilities, and other large buildings.
- Propane produces significantly fewer greenhouse gas emissions than diesel or gasoline.
- Propane is non-toxic, non-poisonous, and won't contaminate soil or water.
- Propane can handle all of a business's energy needs for days, unlike solar- or wind-power systems.



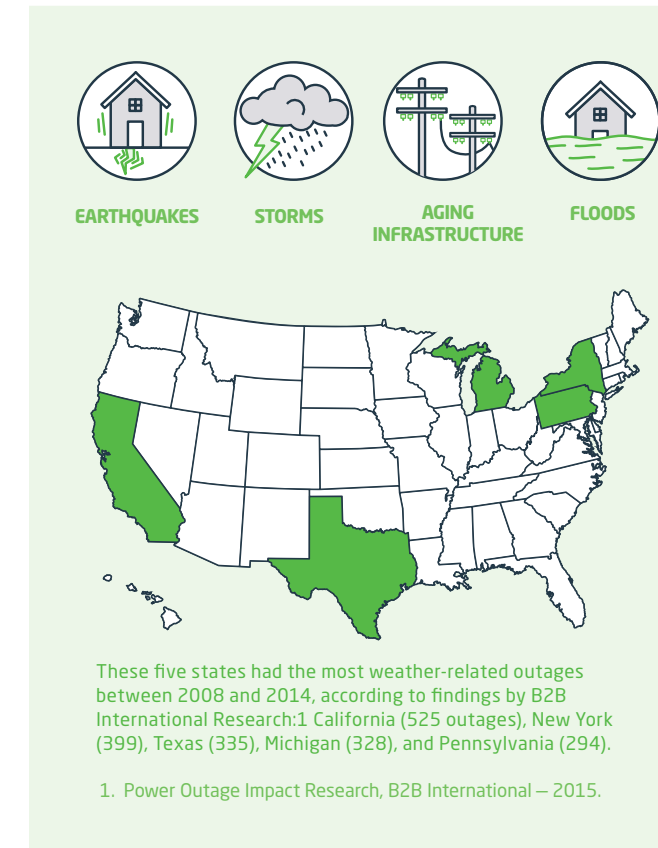
Propane generators offer quiet power and low emissions.

Protecting Businesses

WHAT HAPPENS TO A BUSINESS DURING A POWER OUTAGE?

At best, it's a few minutes of employees standing around talking about the interruption to their day. But at its worst, it's hours or even days without power. Orders piling up. Employees worried about lost hours or working overtime to make them up. Customers going elsewhere. For everyone involved, it's a mountain of stress. And only 19 percent of business owners feel even somewhat prepared for a power outage. Six percent are very unprepared.

A propane standby generator protects against these possibilities. It eliminates the financial losses, the emotional stress, and the damage to a business's reputation that a power interruption can cause.



THE COST OF BEING UNPREPARED

The average business will experience 3.5 power interruptions in a two-year period.¹ Even a short power interruption incurs costs. Longer interruptions can be catastrophic. According to a Power Outage Impact Research report by B2B International:

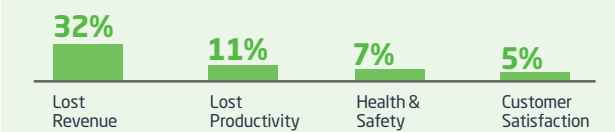
- Relocating a single patient from a health care facility costs roughly \$2,000.
- A manufacturing firm paid more than \$250,000 in lost wages and overtime after a one-day power outage.
- A Washington grocery store lost nearly its entire inventory – more than \$100,000 worth of food – after a multi-day power outage.

Here's what a four- to eight-hour power interruption cost one Midwestern retail food service business.

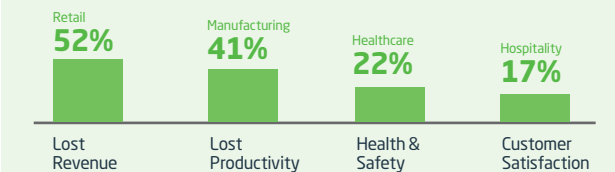
- **Lost business:** "It's difficult to watch customers go to the competition."
- **Lost reputation:** "It opens up a window to lose customers for good, if we can't consistently serve them."
- **Lost confidence:** "It's difficult to make employees and customers understand it's not in our power to fix the situation."

By talking to your customers about the need for a propane generator, you could be saving them hundreds of thousands of dollars, and protecting their reputation into the future.

POWER OUTAGES: WHAT WORRIES BUSINESS OWNERS



TOP POWER OUTAGE CONCERNS BY INDUSTRY



Combined Heat and Power

Micro combined heat and power, or micro-CHP, systems show immense promise as a way to push past the efficiency boundaries of traditional heating or water-heating systems. These cogeneration systems produce both heat and power simultaneously, allowing them to surpass the energy savings of even the most efficient boilers.

One benefit common to all micro-CHP systems is that they utilize an on-site fuel source such as propane to generate the heat and power, eliminating the efficiency losses between a power plant and a building and leading to a lower carbon footprint. Another advantage is that many of these systems provide a low-cost, dependable power source that won't go down with the grid.

At the Northern Maine Readiness Center in Presque Isle, Maine, for instance, micro-CHP systems serve as part of a resilience strategy that is both fiscally responsible and sustainable. The Maine National Guard's Energy Manager, A.J. Ballard, had experience with micro-CHPs at other facilities within the state, so turned to them once again for this project. He particularly likes the free hot water that comes along with the system's other advantages: clean reliable power at a low cost. The micro-CHP systems provide enough backup power to keep the Army National Guard facility operational in case of outages.



The Northern Maine Readiness Center in Presque Isle, Maine.
WBRC Architects Engineers.

Propane and Renewable Energy

With electricity prices on the rise across the United States, many building owners and construction professionals are turning to renewable energy sources to generate heating and electricity. Because propane has low greenhouse gas emissions and can easily be stored on site, it's ideal for enhancing a wide range of renewable energy systems. When properly designed, propane-enhanced renewable energy systems operate with little, if any, intervention from building owners and managers.

ELECTRICAL GENERATION SYSTEMS

In systems where solar photovoltaic panels or wind turbines are used to generate electricity off the grid, a propane generator can provide auxiliary power when stored battery voltage cannot meet the electrical load of the building.

SOLAR THERMAL SYSTEMS

Propane can fuel commercial solar backup systems, which store solar-heated water, provide efficient backup heating at thermal efficiencies greater than 95 percent, and offer controls that easily integrate with upstream solar systems to control flows and temperatures.

BIOMASS HEATING SYSTEMS

Biomass fuels include wood, pellets, dry-shell corn, and other indigenous plant materials suitable for producing heat in a combustion chamber. Buildings with biomass heating systems often use hydronic heating delivery. An auxiliary system is necessary for times when the fire is out or the biomass system is unable to meet a variable heating load, and propane's flexibility makes it an appropriate energy source for these applications.

RENEWABLE PROPANE

With the propane industry introducing renewable propane produced by converting plant and vegetable oils, waste greases, and animal fat into fuel, facilities will soon be able to supplement on-site renewable energy with renewable propane, offering the potential for 100 percent renewable energy.



A Lochivar XRG1 25 micro-CHP system installed at Finger Lakes Community College in Canandaigua, New York, produces 24 kW of power and 163,000 Btus of heat.

Propane is ideal for enhancing a wide range of renewable energy systems.



Outdoor Living

Unlike other fuels such as natural gas or electricity, propane offers portability and flexibility to allow businesses to quickly adapt their outdoor spaces to changing needs. Outdoor amenities can be used to increase the usable footprint of a restaurant, maximize the curb appeal of a building entrance, or turn a patio into a year-round amenity.

FIREPLACES AND FIRE PITS

The urge to socialize around flames is a deep part of the human psyche, so bold fire features are natural winners in hospitality settings. The most crowd-pleasing options for these popular amenities rely on the design flexibility of propane or natural gas, which let designers create inventive styles that wouldn't be practical with traditional wood fireplaces. To accommodate the maximum number of patrons, more businesses are installing linear propane or gas fireplaces in a sleek, contemporary style for use in outdoor patios or dining areas.

COOKING

The addition of an outdoor kitchen can expand a restaurant's appeal and seating capacity. Propane facilitates flexible outdoor kitchen design due to its portability, allowing for equipment reconfiguration and additions with changes in menu and capacity. Propane gas grills also offer more precise temperature control compared with wood and charcoal.

PATIO HEATING

Once a niche outdoor living application for temperate regions such as coastal California, commercial patio heating has taken off nationwide. For restaurants, hotels, and other hospitality businesses, the heating trend is all about maximizing revenue. Restaurants, for example, can turn their outdoor spaces into usable square footage for an additional 12-16 weeks of the year. Portable propane heaters are readily available, while built-in heaters can be installed safely out of the way and plumbed to permanent gas lines.

LIGHTING

Propane-powered lighting can give an outdoor entertainment area or entryway a classic or even contemporary look. Photo-sensors or timers can be used to automatically turn on lights when the sun goes down or at a preset time.

POOL AND SPA HEATERS

Propane pool heaters can be used to extend the swimming season well after other locations have closed their pools. Water temperature can be maintained at the optimum set-point regardless of outdoor conditions. Heaters are easily integrated with the pool's pump and filtration system and can be sized to fit any pool or spa.

Propane In Building Operations

If you're a building owner or facilities professional, you bear the ultimate responsibility for your building's performance. Whether you're acquiring, renovating, or constructing a new project, you want to ensure your building has the right amenities to maximize its value and cost-efficient operation to protect your bottom line.

At your project's budgeting and planning stage, your engineer or architect may recommend propane systems and include them automatically in the plans. If you already have a certain propane application in mind, such as gas cooking for your restaurant, make sure your designer is aware of your preference for propane.

Using propane won't throw a wrench into the construction schedule of your project – in fact, it may speed it up. Since you're not at the mercy of a public utility, your contractor can partner with a local propane retailer to install the propane system where and when it's needed.

REPLACEMENT PROJECTS

Building renovations are one of the best times to consider replacing outdated technology like electric water heaters or boilers that use heating oil. Your building will see improved performance and space savings with a high-efficiency propane system, and it's much easier to make the switch proactively than to wait until the older unit fails.

Switching to propane won't mean shutting down your business for days without hot water. Your contractor can install your new system (as well as your propane storage, if needed) and have it inspected and tested before switching over from your old unit, minimizing any disruption. If you're switching from heating oil, your old oil tank can be decontaminated and either removed or permanently taken out of service.

YOUR PROPANE STORAGE SYSTEM

Your engineer, contractor, and propane professional can help you navigate any decisions you need to make about propane storage. They'll provide guidance on appropriately sizing the tank for the needs of your business.

Reviewing the tank location options with your builder and propane retailer is a great opportunity to make your aesthetic preferences known. In some cases, you may have the opportunity to bury the tank out of site. Building and safety codes and ease of access will also govern the final choice. Landscape design can ensure your propane storage fits in with the design of your property.



Propane in Restaurants

Restaurant chefs overwhelmingly prefer gas appliances over electric models due to propane cooking equipment's greater temperature control and capacity levels.

WATER HEATING

In high-demand scenarios, an array of propane tankless water heaters is a space-saving and cost-efficient way to produce hot water. These tankless racks create redundancy, so the hot-water supply will continue even if one unit is out of commission. Tankless water heaters used in commercial applications offer economical, on-demand, endless hot water, and they can be installed inside or outside, depending on climate.

SPACE HEATING

An efficient rooftop furnace can quickly and cost-effectively heat a restaurant, and it can serve two different zones for the kitchen and seating area. Newer units have multiple stages and microprocessors to reduce energy costs, along with variable airflow to meet diverse heating loads.

COOKING

Compared with electric cooking systems, propane appliances offer greater control of heating levels, instant-on burners, greater capacity levels, and even heat distribution.

FIREPLACES

Propane fireplaces can be used for decorative or space-heating purposes. Propane units are "heater-rated," meaning they can provide efficient heating to an individual room or space, such as the seating area of a restaurant. High-efficiency propane fireplaces can achieve fireplace efficiency (FE) ratings of more than 90 percent.

PATIO AMENITIES

Radiant heaters, wall sconces, and tiki torches maximize the curb appeal of your patio and entrance area. Propane patio heaters extend the outdoor living season by raising the outdoor air temperature to comfortable levels. Fire pits, hearths, and decorative flame features provide a cozy amenity and gathering place to highlight an outdoor courtyard or patio.

PROPANE TANK

A high-demand setting such as a restaurant may require multiple tanks, buried to preserve parking and views from the patio area. Propane suppliers will work with individual businesses to determine the proper size and number of tanks to meet the building's propane needs.

Propane in Retail

For owners of retail facilities like banks and pharmacies, the bottom line is always top of mind, and they can't risk any downtime or negative impact on their operations from an unreliable source of energy.

WATER HEATING

In low-demand scenarios, a single tankless unit installed near the point of use greatly reduces delivery times and standby heat losses. A small installation footprint reserves valuable square footage. A propane-fueled tankless water heater offers economical, on-demand, endless hot water with up to 61 percent fewer emissions than electric water heaters.

SPACE HEATING

An efficient rooftop furnace can quickly and cost-effectively heat a small or midsize retail building. In these buildings, packaged RTUs are air conditioners with a propane or natural gas heating section. High-efficiency propane furnaces – generally those with efficiency levels above 90 percent AFUE – capture additional heat from the combustion gases and use this to increase the heat transfer of the furnace for greater efficiency.

STANDBY GENERATOR

Standby generators can provide backup power for heating and cooling systems, keeping your business open and protecting against damage to perishable inventory. While storms, unpredictable weather, and unreliable power grids create an uncertain supply of electricity, propane is a safe and dependable energy source that won't fail in a storm.

METERED SERVICE

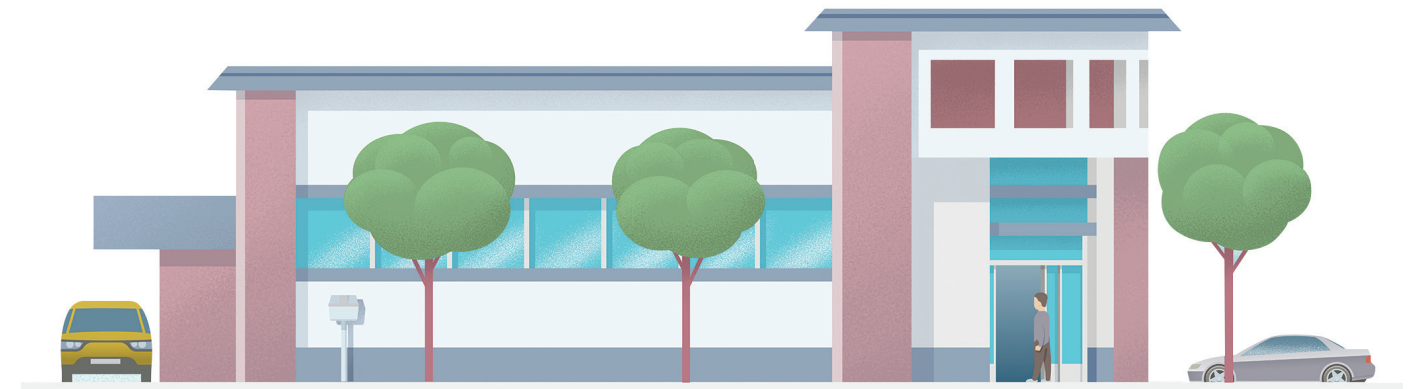
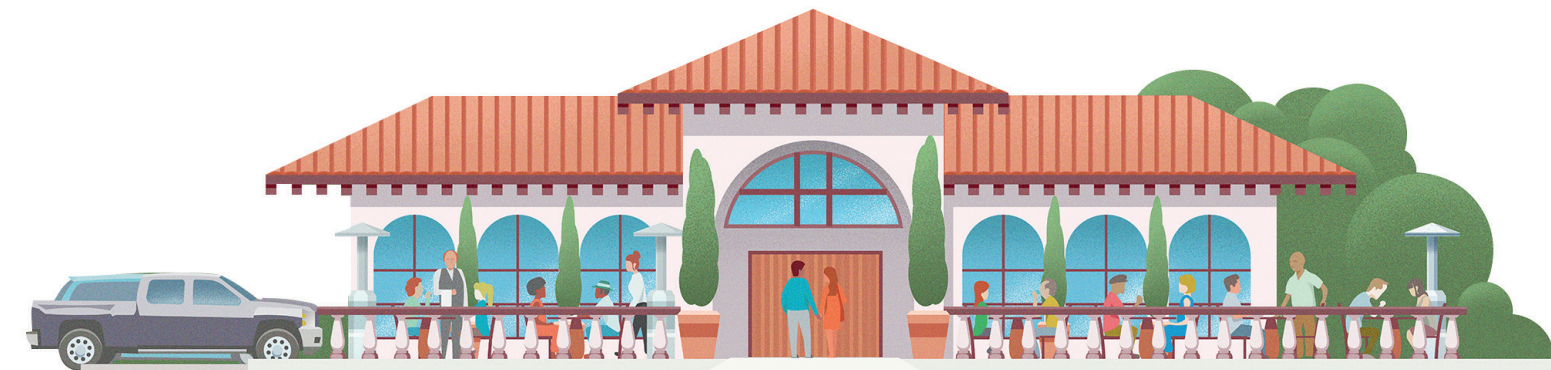
In retail buildings such as strip malls, propane metering is a hassle-free way of providing propane service to tenants, even if they draw from the same tank. Instead of owners needing to divvy up the costs of unequal use among the tenants, or simply attempting to recoup the cost with higher rent, meters provide a surefire way to bill the exact cost of propane to the tenants who use it.

VAPORIZER

A vaporizer is essentially a boiler that uses heat to aid the natural vaporization process of propane from liquid to gas. The result is a virtual increase in the Btu delivery capacity of the system without a corresponding increase in the size or number of the propane storage tanks – which may not be possible where space is limited.

PROPANE TANK

A single 1,000-gallon underground tank is a common size for this type of building. Underground burial helps maintain limited parking and enhances safety.



Propane in Schools

School administrators have enough to worry about with large student populations and ever-tightening budgets. The last thing they need to worry about is the reliability – or the cost – of their heating. Schools heated with propane can cut down on their utility bills while utilizing trustworthy systems that ensure the heating won't fail at an inopportune time.

WATER HEATING

A large building, such as a school, may combine local propane tankless water heaters near rooms such as bathrooms and science labs with larger commercial storage tank water heaters near the cafeteria. Storage tank water heaters can supply domestic hot water to consistently high demand from the kitchen or showers, while tankless units support the use of low-flow fixtures, offering a turndown ratio of 20:1 for more precise and efficient response to hot-water demands.

PROPANE BOILER

For many schools and institutions, high-efficiency propane boilers are the most cost-effective heating option. High-efficiency propane combination space- and water-heating systems can provide both domestic hot water and hydronic heat, as well as supplemental heating for pools when needed.

COOKING

Both professional and aspiring chefs prefer propane gas cooking appliances in the cafeteria kitchen or culinary classrooms. Commercial kitchen appliances are energy intensive, so choosing energy-efficient gas appliances is a smart choice. Additionally, propane cooking equipment typically lasts eight years or more in most commercial kitchens, besting electric equipment.

SNOWMELT SYSTEM

Buried hydronic heating pipes create safe, low-maintenance, snow-free walkways and playgrounds, reducing dangerous slippery surfaces. The use of snowmelt systems reduces maintenance and cleanup of entrances and common outdoor areas by eliminating the need for salt and snow removal. In turn, these systems help prevent slush, mud, and salt from entering the school. Smart controls ensure the system runs only when it needs to, reducing energy costs.

STANDBY GENERATOR

Educational buildings can become shelters during emergencies, supplying electricity, heat, air conditioning, and hot water. On-site generators fueled by propane allow for institutions to stay open during and after hurricanes and severe storms that bring widespread power outages. Propane generators can maintain lighting, heating, air conditioning, and refrigeration.

VEHICLES

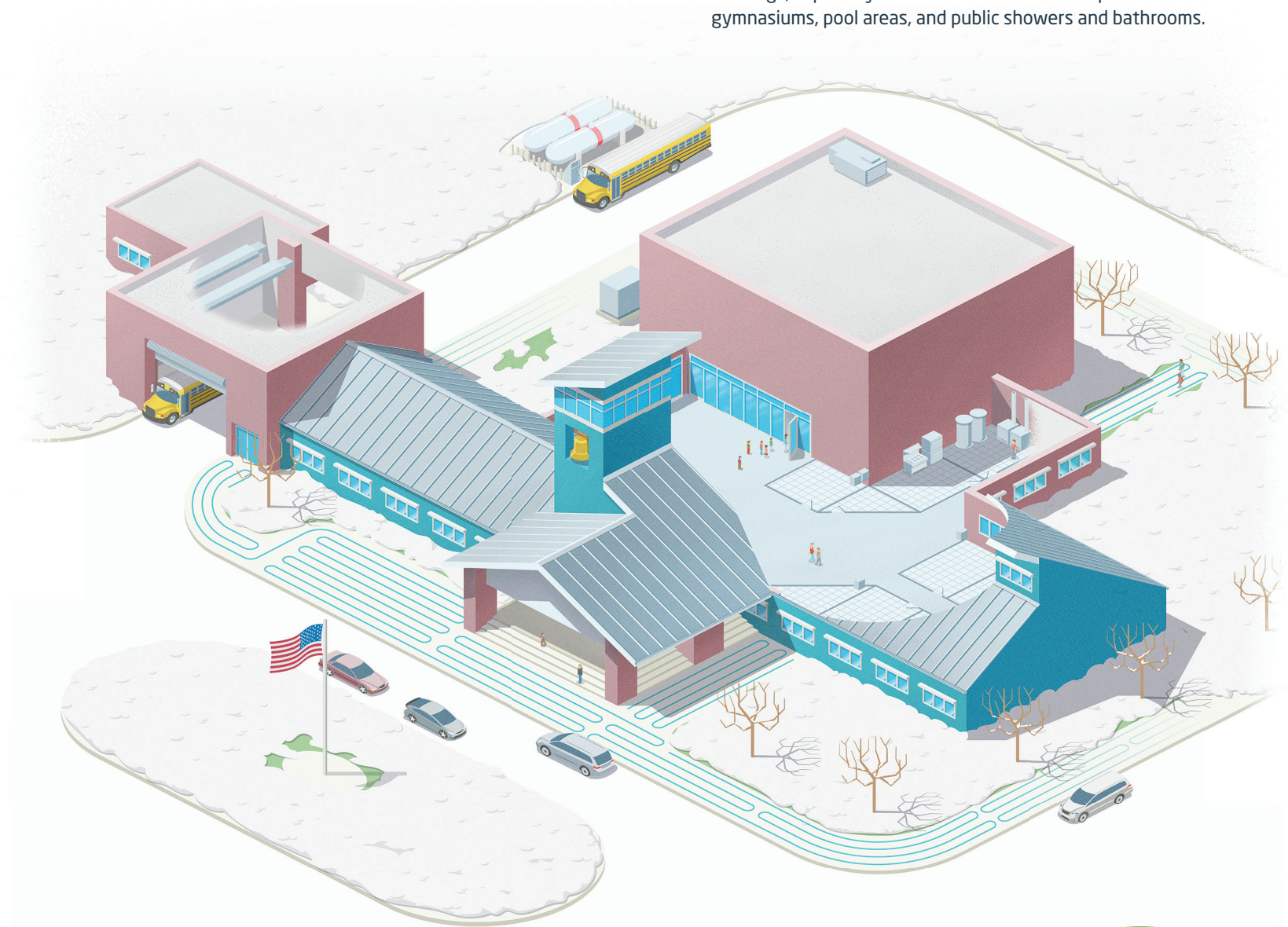
Off-road and on-road vehicles running on propane last longer and cost less to fuel and maintain. School systems across the nation are switching to propane fuel systems because they are more cost-effective than gasoline or diesel and produce fewer harmful emissions. Propane-fueled mowers reduce greenhouse gas emissions by up to 17 percent compared with gasoline-fueled mowers,¹ a plus for school districts that specify a sustainability requirement.

PROPANE TANK

In this example, an 18,000-gallon aboveground tank supplies propane to the applications in the main building as well as fuel for propane vehicles and mowers. Tanks can be fenced, buried, or landscaped to enhance security, safety, and aesthetics.

DEHUMIDIFICATION

High humidity levels inside buildings can create a series of problems, such as mold growth, condensation concerns, and complaints about lack of comfort. Propane-fueled desiccant dehumidifiers remove and control high humidity levels inside buildings, especially in humid climates and for spaces such as gymnasiums, pool areas, and public showers and bathrooms.



1. Nexight Group and Energetics Incorporated, A Comparative Analysis of Greenhouse Gas Emissions From Propane and Competing Energy Options, (Washington, D.C.: Propane Education & Research Council, 2014).

Propane in Lodging

Propane can transform hospitality projects inside and out. Guestroom fireplaces or outdoor fire pits and hearths provide ambience and cozy gathering spaces. Efficient propane water heaters, furnaces, and kitchen appliances can help slash operating costs while keeping guests comfortable and satisfied.

WATER HEATING

About a quarter of a hotel's energy consumption goes toward water heating. Multiple propane tankless water heaters combined together in an array can offer a solution that saves space and meets a hotel's fluctuating hot-water demand efficiently.

SPACE HEATING

By delivering more-even heat, and more heat closer to the floor, boiler-fed radiant heating systems can be an energy-efficient heating source throughout a lodging building. High-efficiency propane boilers are a cost-effective heating option, and they can be paired with water-heating systems to provide both domestic hot water and hydronic heat.

LAUNDRY

Because of their efficiency and heating capacity, propane and natural gas are most commonly used for commercial clothes and linen dryers. High-efficiency propane-fueled dryers minimize drying time and reduce greenhouse gas emissions compared with electric dryers.

COOKING

Propane and natural gas restaurant-grade kitchen appliances are the cooking tools of choice for hospitality chefs. Gas cooktops offer unsurpassed control, with precise temperature adjustments and more-even heat distribution than electric stoves. Compared with electric cooking systems, propane appliances also offer greater control of heating levels, instant-on burners, greater capacity levels, and even heat distribution.

FIREPLACES

Fireplaces add warmth and ambience to guestrooms and welcome areas and can provide comfy, efficient heating to a room or space. Fire pits, hearths, and decorative flame features provide a cozy amenity and gathering place to highlight an outdoor courtyard or patio. Two-sided fireplaces take it to another level by separating two defined areas for cocktails and for dining.

PATIO AMENITIES

Patio heating allows hotel dining rooms to expand their seating area to the outdoors and extend the outdoor dining season. Rustic outdoor lighting and propane-fueled flame features can give your destination a unique look that your guests won't forget. Restaurants can even add a seasonal outdoor kitchen with propane grills or cooking appliances.

COMBINED HEAT AND POWER (CHP)

CHP systems create electricity while providing supplemental heat for a hotel's swimming pool and radiant heating system. Because of their year-round hot-water loads for laundry, pool heating, guestrooms, radiant heating, and more, hospitality buildings are an ideal candidate to utilize this rapidly growing technology, which can also provide electricity during power outages.



Propane in Warehouses

Providing affordable heating for cavernous warehouses or big-box stores might seem daunting, but with systems including propane-fueled heating, high-capacity water heaters, and backup generators, large buildings can keep all systems running comfortably and efficiently 24/7.

WATER HEATING

Propane tankless water heaters achieve energy factors as high as 98 percent and can be strategically combined into high-capacity banks. These tankless rack systems can vent outside using a common venting system and can be assembled off site, increasing speed and ease of install. They can also rotate the firing sequence of the water heaters, greatly improving the system's efficiency and life span.

SPACE HEATING

Floor-level air rotation systems are used for heating facilities up to 150,000 square feet and cooling facilities as large as 100,000 square feet. Propane combustion provides thermal energy to the heat exchanger, while propane glycol is used for cooling purposes. These systems eliminate the need for multiple rooftop units, roof penetrations, and duct work, and they can be completely operational in 1-2 days.

STANDBY GENERATOR

In a warehouse or manufacturing environment, even small power outages can lead to costly downtime or damaged inventory. Standby generators can provide backup power for heating and cooling systems and lighting, keeping your facility open and ensuring your customers get their product on time. Propane is a safe and dependable energy source that won't fail in a storm or grid outage.

COOKING

A warehouse or big-box store may include propane cooking appliances in the employee break room as well as in the appliance demo area. Consumers prefer cooking with gas, and fueling demo appliances with propane allows for live cooking demonstrations and special events.

DEMONSTRATION AREAS

Propane home improvement products such as fireplaces, torches, and outdoor heaters lose their visual punch without a live gas connection. Home improvement stores can use on-site propane to show off these dazzling flame effects and comfort benefits to consumers.

VEHICLES

Propane-powered forklifts can be used safely indoors or outdoors because they operate so cleanly. Unlike electric forklifts, propane forklifts don't lose power throughout the workday, and a fast, easy cylinder change gets them back in business quickly.

PROPANE TANK

A propane tank for this type of building may serve the fuel needs of the building as well as a propane refueling station. Commercial and industrial applications may use multiple tanks or a single high-capacity tank, depending on the needs of the building.



Temporary Heat

Propane-fueled temporary construction heat keeps projects on schedule throughout the coldest months of the year.

Temporary heaters have come a long way from the days of mushroom-style pot heaters, which had the potential to spread carbon monoxide throughout a building. Today's heaters run much more efficiently, using technology such as electronic modulating burner controls and remote space thermostats to automatically adjust gas flow. They can also draw clean outside air for combustion or be placed outside with temporary ductwork to deliver heat to the building. And they are available for seasonal rental.

Construction heaters range in size from small, portable heaters that produce about 35,000 Btus of heat to large heaters capable of heating hospitals or resorts, with energy outputs up to 5 million Btus. Combined with proper ventilation, temporary heaters allow construction materials such as floor finishes, drywall, plaster, and paint to dry and cure even during cold weather.

Temporary construction heat can also keep your workers warm and productive. In some regions, codes or safety regulations require that workers have a supplementary heat source when work area temperatures drop below a certain level.

Temporary heat also offers a solution when facilities need to erect temporary structures. During the 2020 pandemic response, for instance, propane temporary heaters were used to heat a range of facilities, from outdoor drive-through testing sites to tented overflow facilities fully ducted to meet air-quality requirements.

Regardless of the application, propane offers a clean, readily available energy source. On many projects, a natural gas connection isn't available until the building is nearly finished. Propane, on the other hand, is portable and convenient. Project managers can work with their local temporary heat and propane provider to budget and plan for construction heat. The process is mostly turnkey from start to finish; the builder simply needs to duct the heat into the building and power it as needed.



Temporary construction heat can keep your workers warm and productive.

Construction Equipment

JOBSITE POWER GENERATORS

Small portable and large towable propane generators provide convenient and trustworthy power for construction crews working on sites not yet connected to the power grid. Approved for use outdoors, these generators provide on-the-go power without the tradeoffs of gasoline. Towable generators, available in sizes ranging up to 450 kVA, can be fueled by an onboard or external propane tank and are designed for prime applications.

HYBRID LIGHTING

Solar hybrid light towers offer long-lasting jobsite lighting with onboard propane generator backup, ensuring the lights stay on even when the photovoltaic panel isn't charging. They can offer significant operational savings over diesel models: about \$5,800 a year for a unit operating 70 hours per week.

FLOOR CARE

Floor burnishers, polishers, and strippers are available with propane engines, providing cordless operation and long working time between refills. The equipment uses an emissions monitoring system that shuts down the engine if oxygen levels in the exhaust surpass preset limits. Recently, manufacturers have introduced new propane grinders that are ready to run right off the truck, with no electrician or setup time needed. New power trowels in propane models allow these powerful machines to be used on indoor projects, offering the potential to vastly boost productivity.

FORKLIFTS AND SCISSOR LIFTS

A variety of warehouses around the United States already use propane-powered forklifts for their performance benefits, and because they can run indoors, they're also useful on construction sites after the building is enclosed. Unlike electric products, propane forklifts and scissor lifts don't lose power throughout the work day and don't require hours of charging to get back to work. Just switch out the propane cylinder and you're back to work.



Propane Autogas

Whether you're a construction professional or a business owner, there are plenty of reasons to switch your vehicles from gasoline or diesel to propane autogas.

Propane autogas is flexible enough to work in both on-road vehicles – such as work trucks, school buses, shuttle vans, and maintenance or delivery vehicles – and off-road vehicles such as forklifts and lawnmowers. After an initial investment, your business can expect to save money in areas where conventional and other alternative fuels would pile on to your operating costs.

FUEL

Mile for mile, propane autogas costs less than gasoline or diesel. And when you add in federal and state government fuel tax credits, the already competitive payback period on propane autogas investments is even shorter.

MAINTENANCE

Thanks to the dependable, clean performance of propane autogas, work vehicles will have lower maintenance costs than with conventional fuels. Unlike diesel engines, propane autogas engines require less oil by volume, no additional filters, and no costly emission fluids, which means lower costs during each maintenance cycle.

INFRASTRUCTURE

Propane autogas is abundant. Many fleet owners prefer having a refueling station located on their property. Installation of propane autogas refueling infrastructure is affordable. It costs much less than installing a compressed natural gas (CNG), gasoline, or diesel refueling station.

With thousands of refueling stations located across all 50 states, propane is an accessible, readily available low-carbon fuel. To obtain state-specific information about propane refueling locations, use the Alternative Fueling Station Locator, maintained by the U.S. Department of Energy.

Propane Building Resources

PROPANE.COM

Construction pros should visit **Propane.com** to check out the latest news and insights on building products and trends, learn how to install and operate propane equipment, and find information on construction-related events, conferences, and conventions.

The site has a wealth of research and resources on propane-fueled equipment and building systems. You'll find training and case study videos, the Virtual Commercial Buildings interactive tool, and fact sheets and ebooks to help you maximize the performance of your buildings. While you're there, sign up for the Build With Propane newsletter to receive updates on news and products for commercial construction professionals.

WHERE TO BUY PROPANE AND PROPANE EQUIPMENT

Propane.com/Where-To-Buy

A propane professional can give you answers to your questions about propane applications. Use this handy online tool to find a propane retailer in your area, and you'll be on your way to a successful propane project.

HANLEY WOOD UNIVERSITY

Hanleywooduniversity.com

Our training courses at Hanley Wood University were created to provide architects, engineers, builders, and other construction professionals with free and informative training materials on propane and its many applications, installation specifics, and products. The courses on this site are registered for education credit with the American Institute of Architects, Green Building Certification Institute (in conjunction with the U.S. Green Building Council), National Association of The Remodeling Industry, and National Association of Home Builders, and they're a smart way for certified construction professionals to maintain their standing with those organizations.

